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K/EM-186

SANITIZED VERSION OF BI-WEEKLY PROGRESS REPORT  
FOR WEEK ENDING MAY 24, 1946  
(Sanitized Version of CRD Document # KZ-235)

Compiled by  
S. G. Thornton  
Environmental Management Division  
OAK RIDGE K-25 SITE  
for the Health Studies Agreement

September 12, 1995

Oak Ridge K-25 Site  
Oak Ridge, Tennessee 37831-7314  
managed by  
LOCKHEED MARTIN ENERGY SYSTEMS, INC.  
for the U.S. DEPARTMENT OF ENERGY  
under Contract DE-AC05-84OR21400

This document has been approved for release  
to the public by:

*Thomas W. Kelley* *WAS* *Print* *9/15/95*  
Technical Information Officer Date  
Oak Ridge K-25 Site

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**PLANT RECORDS** 1950

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CARBIDE AND CARBON CHEMICALS CORPORATION

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JUN 7 1946

G. T. FELBECK

✓  
K Z-235

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PROCESS DIVISION

PROCESS DESIGN AND DEVELOPMENT DEPARTMENT

A. B. HALE

BI-WEEKLY PROGRESS REPORT

For Week Ending May 24, 1946

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PLANT RECORDS 1950

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DEVELOPMENT SECTION

W. C. Moore

RESTRICTED DATA  
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Compiled by: J. A. Connors

B1-Weekly Report Ending 5/23/46

A. Plastics

One thousand grams of MFP have been processed for use as Chapman valve seats and an additional 500 grams have been processed for other uses in the Development Section. Five pounds of MFP plus 5 pounds of  $TF_4$  were pulverized, mixed, and dried for use in sheeting material for the Special Hazards Group.

B. "T" Recovery from Solutions

1. The following quantities of carbonate solution have been handled during this period:

Class A	990 gals., Filtered and processed
Class B	1265 gals., Filtered and processed
Class D	550 gals., Filtered and ready for processing

2. The following amounts of oxide ( $T_2O_8$ ) have been prepared and are ready for shipment to K-1301 for fluorination:

Class A	68 lbs. 13 oz.
Class B	37 lbs. 8 oz.
Class D	2 lbs. 3 oz.

Total 108 lbs. 8 oz.

3. Sixty pounds of  $(NH_4)_2T_2O_7$  have been prepared and are ready for muffling.
4. Three drums of laboratory mixtures have been processed during this period. The solids in these mixtures were dissolved with HCL and the resulting solutions then treated by the regular carbonate recovery method.
5. Approximately four pounds of  $Na_2CO_3$  residue resulting from the evaporation of about 15 gals. of solution have been fluorinated. Laboratory results showed 0.89% "T" left in the residue after fluorination.
6. Fifteen to twenty thousand nickel discs with  $T_2O_8$  oxide coatings have been cleaned during this period, and the recovery solutions are to be treated for the reclaiming of "T".

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C. MFI

Five pounds of a high melting MFI wax have been prepared for use in impregnation of carbon seal rings. By the addition of 10 per cent MFP-10 to MFI, the melting point was raised from 185°F to 350°F.

D. Fluorocarbon Processing

1. One hundred and twenty five pounds of contaminated MFI have been recovered during this period. Laboratory analysis for inertness value will determine the necessity of treatment with FM-33.
2. One thousand six hundred and twenty five pounds of Freon mixture were obtained from Cascade Services and 1390 lbs. of Freon have been recovered.

E. DTE - Vacuum Pump Oil

During this period, 150 gals. of DTE vacuum pump oil were recovered.

F. C-816 - C-616 Phase Relationships

An equilibrium still has been constructed for the study of the phase relationships of C-816 - C-616 in distillation.

G. Swelling of Rubber by Solvents

After an investigation of the problem of the "swelling" of rubber by various extracting solvents, it was determined that those solvents which have the least effect on Neoprene rubber are Freon-113, C-714, acetone, butyl alcohol, and isopropyl alcohol. It was suggested to Process that either Freon-113 or C-714 be used and that the Chemical Development Unit would recover the used solvent.

H. Dew Point Trace Indicators

1. Thirteen trace indicators were installed in the seal exhaust lines three months ago and were allowed to run during this time. During this past week, each dew point was measured simultaneously by both the platinum plate method and the visual indicator, and the average difference between dew points as determined by the two methods was found to be 4.7°F.
2. Dew point trace indicators have also been installed in the cell ambients of cells 1, 3 and 6 of K-303-2 and readings are being checked at regular intervals with a platinum plate apparatus. In addition, two other trace indicators have been installed in the K-1100 Section, one in the plant air feed line and the other in the cell ambient air feed line.

I. Water Corrosion of Pipes

A laboratory program is now underway to determine the nature and ex-

tent of corrosion in water lines by water contaminants. Twenty seven samples have already been taken.

J. Reaction between HF and O<sub>2</sub> in the Cascade

The apparatus for the determination of the consumption of C-616 by the possible reaction between gaseous HF and O<sub>2</sub> has been completed. Conditioning of the nickel surfaces to a film thickness of 100 Å<sup>0</sup> is being started immediately.

K. Viscosity Plate Seals

1. The results of the Daily Seal Inspection Program are tabulated below: (Reports 44 to 49 inclusive.)

Type of Seal	Inspection Data				Reasons for Removal					No Info. Avail.
	No. Insp.	Melted Solder	Heavy Wear & Corr.	Failed Parts Not Evident	Would Not Hold Exhaust	Seal Feed High	Re- place- ment	High Air In- leak- age	Other	
H-4	41	8	30	3	8	18	0	3	1	11
L-7	4	2	1	1	1	0	0	0	3	0
H-1	3	0	3	0	0	0	0	0	0	3
L-5	24	3	16	5	0	2	10	0	0	12
L-6	3	0	2	1	0	0	0	0	0	3
Totals	75	13	52	10	9	20	10	3	4	29

2. Analysis of gas forces on the stationary plate of a low pressure seal shows the design produced to be the best possible with respect to elimination of obnoxious gas loading under the design conditions.
3. Analysis of the operation data of the new natural rubber, reinforced Belleville gaskets for the K-306 Section shows them to be satisfactory to date.

L. Valley Iron Pump

1. The set of amorphous carbon seals impregnated with MFI continue to perform satisfactorily with little change in leak rate during the last 800 hours. The running time to date is: G-74 - 40 hrs. 44 min., 65 per cent C-616 - 1010 hrs. 6 mins., total - 1050 hrs. 50 mins. The leak rate at present is 0.049 std. cu.ft/min. with a seal feed differential of 0.50 psi.

2. The tests on the labyrinth seal have been completed and the results are being calculated. A set of six graphite seals have been impregnated with MFI and are being mounted in this pump for a life test.

M. Keller "Always Safe" Cold Trap - 509A

The trap was tested on gas mixtures containing up to 20 per cent C-616. At these concentrations, it was found necessary to reduce the flow rates to less than 1 mol per hr. It was agreed that it would not be necessary at this time to test the effect of contaminants on trap operation. The testing of this trap is therefore complete and a report is being prepared.

N. Mist Filter Test

A test has been conducted to determine how much moisture entering the pump suction is required to plug the mist filter. Approximately 200 grams of water were required to attain a pressure drop of 2 psi across the filter. The filter and pump are now being disassembled for examination.

O. Coolant Drying

The Mechanical Development Unit has been assisting in the start-up of the 300-C drying plant for the past two weeks. The plant has been in operation for 24 hours at this date, and, when a 48-hour run is completed, the quality of the coolant will be determined.

P. Converters

1. Three moisture plugging tests have been completed on converter E-101 using controlled wet air leaks located at the converter inlet, the adsorber inlet, and at the Elliot Blower suction. TO<sub>2</sub>F<sub>2</sub> plugging, as calculated on the basis of initial porosity and expressed as water, was found to range from Radiation measurements indicated that most of the TO<sub>2</sub>F<sub>2</sub> dust deposited on the barrier and on the adsorber, and that relatively little dust passed through the barrier.
2. The calculations for the procedure for the experimental determination of the effects of temperature and pressure on permeability are being made, and construction changes on conditioning stand B-15-S have been started.

Q. Corrosion and Consumption

Pump parts have been specimened and are currently undergoing surface analysis, however, insufficient analytical data are available at this time to derive any conclusions.



R. C-616 Consumption Tests in K-312 Section

The dynamic consumption test on cell 12 of K-312-2 was stopped after two weeks of operation due to instrument difficulties encountered on the special "sampling and evacuation" manifold. The total consumption during the 14-day period was 225 grams of C-616, which corresponds to an average consumption rate of 16 grams per cell per day. This consumption rate should be regarded with caution. as the test was conducted with the "B" stream temperatures <sup>Gauge</sup> to operation with inlet coolant valves closed. Furthermore, the consumption rate had not leveled off at the end of the two week period. It is planned to recharge the cell this week and to continue the dynamic test.

S. Line Recorder

1. The history of the Line Recorder at K-25 has been completed, however, publication will await the preparation of a preface by Dr. A. O. C. Nier.
2. A study was made at the request of the Seals Unit to determine the amount of G-74 inleakage into each section of the plant and the average G-74 concentration in each of these sections.

T. Radiation Survey

1. Special alpha surveys were made of experimentally plugged converters in Building K-1401.
2. Alpha, beta and gamma measurements were made on an A. C. blower which was removed from the cascade for corrosion and consumption studies.
3. The following is a summary of radiation survey checks.
  - a. Plant, Conditioning and Laboratory Areas: 271 beta-gamma  
5 alpha
  - b. Personnel and film badges: 160 beta-gamma
  - c. Carbon traps: 52

V. Reports Issued

1. "Visual Type Gauge for Special Beach-Russ Pumps", No. 3.37.1, 5/7/46, by I. T. Dudley.
2. "Low Pressure Performance of the Type W-Pump", No. 3.59.1, 5/8/46, by J. Zasler.
3. "Experimental Converter Plugging Tests Progress Report", No. 1.5.8, 5/10/46, by J. A. Palermo and S. Visner.

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4. "Flow Data for K-312", 5/13/46, by B. H. Tollefson.
5. "Proposed Tests on A. C. Pump Seal", 5/15/46, by  
M. C. Chervenak.
6. "Experiment of Valve Seat Leak Rates", 5/20/46, by  
W. J. Angulo.

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## PROCESS ANALYSIS SECTION

### BIWEEKLY PROGRESS REPORT ENDING 5-24-46

G. A. Garrett

#### I. Separation Performance Group

##### A. Plant Operation Using T.V.A. Power

This study has been initiated to determine the product purity and production rate that could be maintained if T.V.A. became the only source of power for K-25 and K-27. Preliminary calculations indicate that, with K-25 operating at (306 shut down) and K-27 operating unchanged, the final steady state concentration would be about 50% of the present concentration at the same production rate.

##### B. Partial Operation of K-25 and/or K-27.

Calculations have been started to determine the amount and the concentration of material which can be withdrawn when various sections of the plant are considered as independent cascades. The first calculations will be carried out using K-27 as a separate plant. Following this several sections of K-25 will be considered as independent plants operating with and without K-27. This study is extensive and will require a month of calculations.

##### C. Partial 45 Cycle Operation.

Calculations were made to determine the effect on product purity if each section of the K-25 plant were operated individually at 45 cycles. A tabulation was given in the report "Study of Operation of K-25 at 45 Cycles" showing the following steady state data for reducing the frequency from 60 cycles to 45 cycles individually in each section of the K-25 plant.

1. Decrease in product purity.
2. Power reduction.
3. Decrease in product purity per KW of power reduction
4. Relative increase in T inventory
5. Increase in enriched X inventory.

#### II. Statistics Group

##### A. Plant Performance

1. A method of least-squares fitting of cascade gradient data has been developed to give more precise evaluations of the constants for the method of plotting concentration curves as a straight line. This will permit better evaluation of "average  $\sqrt{}$ 's and "average flows" that are determined from this method.

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2. Direct plotting of the mean fractional enrichment per building versus the building position appears to be the best way to detect buildings deficient in enrichment. The method of calculation and the method of correcting for different types of barrier has been published.

A better method of computing the precision of individual points for this method is being developed. At present, it is not possible to state the confidence with which the building is judged deficient.

#### B. Miscellaneous

Clinical data on red-blood corpuscle count, hemoglobin, white corpuscle count, and blood pressure are being analysed for trend.

### III. Engineering Data Group

#### A. Plant Operating Characteristics

Plant characteristics have been studied at 45 cycles. A compilation is being made of circuit balance-calculated flows, horsepower, interstage pressures, inventory, and control valve positions covering operation from 45 cycles to 65 cycles for all sections of the K-25 plant.

#### B. Material Balance

A survey of the last six months accountability figures shows that the monthly loss of T has averaged about 500 kg  $\pm$  1200 Kg, whereas the monthly balances on X have shown an average gain of 3 Kg  $\pm$  18 kg.

The usage of feed concentration as 0.714 mol % instead of 0.73% is primarily responsible for the apparent gain of X.

#### C. Replacement of Barrier

A calculation was made to determine the effect of replacing all the barrier in the plant with barrier but making no other change in equipment. A product purity three times the present purity could then be maintained with substantially no change in the present X output (assuming no losses). With no barrier replacement and the same assumption of no losses, the X output would decrease about 15%.

### IV. Reports Issued

1. Performance of Combined Plants at 90% Product Purity, 2.8.7, E. S. Johanson, 5/15/46.
2. Effect on Production of Leaks in By-Pass and Inverse Recycle Valves, 2.30.2, G. A. Garrett, 5/22/46.

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3. Approximate Method of Predicting Unsteady State Behavior of Tapered Cascades, 2.12.2, E. Melkonian, A. M. Squires, F. A. Ficken; 5/24/46.
4. Relative Building Separation Efficiency Determined by Fractional Enrichment Curves, 2.1.7, N. Heerema, 5/24/46.

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PROCESS DESIGN SECTION

Period Ending May 24, 1946

A. A. Abbatiello

1. Dry Vacuum Pump

Experience with the 6"-J-Pump indicates that disc type valves are superior to flapper valves for high discharge pressures in reciprocating dry vacuum pumps. However, the present 6"-J-valves are not entirely satisfactory due to fraying of the disc edges. A new disc valve has been designed which should eliminate this difficulty because it has a spring loaded disc and consequently does not depend on deformation of the valve disc for its operation.

The preliminary design of a new dry vacuum pump has been completed. This pump incorporates many of the proven features of the other reciprocating vacuum pumps. It is essentially a combination of the modified W-Pump head, the B-4 Pump drive and the R-Pump carbon-seal.

2. Recovery of T from Carbon

In recovering T from carbon, two methods are under consideration for the oxidation step:

a. The carbon is oxidized in trays by passing air over each tray. This method has the advantage of controlled burning and retention of the ash (which contains the T) on the trays. Its chief disadvantage is its slow reaction rate and the comparatively large size of the equipment.

b. The carbon is suspended in a stream of hot air in a vertical reaction chamber, i.e. "jiggled". This method has the advantage

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of high reaction rate and small equipment. Its chief disadvantage is in developing an efficient system of ash collection.

#### C-816--C-616 Separation

The various designs for C-616--C-816 Separation are based on reducing C-816 peak concentrations from 3% to 1%. A concentration of 3% C-816 in the cascade is the maximum which can be tolerated and still not reduce line recorder sensitivities in 50% of the line recorder units. The rate of withdrawal of C-816 is limited for each design by the following factors:

- a. Capacity of available pumps.
- b. Characteristics of each process, e.g. maximum vapor velocities in distillation.
- c. Off stream hold-up

In all the proposed methods data are lacking. However, in each system the design is being carried as far as possible to determine any limitations and so that the data may be applied as soon as they become available.

In addition to the three methods of separating the indicated minimum boiling point mixture of 80% C-616 20% C-816 listed in the preceding bi-weekly report, four other methods are being studied. These are:

IV. Dr. Benedict proposed the addition of a third component such as MFL. When third components are added to azeotropes, a vapor-liquid equilibrium curve of entirely different shape may result. Sometimes the new curve has no minimum boiling point. This can only be determined experimentally. An equilibrium still, to be operated by the laboratory, has been designed and is under construction.

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V. The available literature on thermal diffusion is being studied.

VI. H. F. Priest proposed a method based on that formerly used in eliminating C-816 from process gas samples for spectrometer analysis. This involves selective sublimation. Fragmentary data is available on this method.

VII. The available literature on gas-phase centrifuging is being studied.

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